THE MARINE MOLLUSKS OF GRAND CAYMAN ISLAND, BRITISH WEST INDIES

MONOGRAPHS
OF
THE ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA

Number 11

THE MARINE MOLLUSKS OF GRAND CAYMAN ISLAND, BRITISH WEST INDIES

By
R. Tucker Abbott

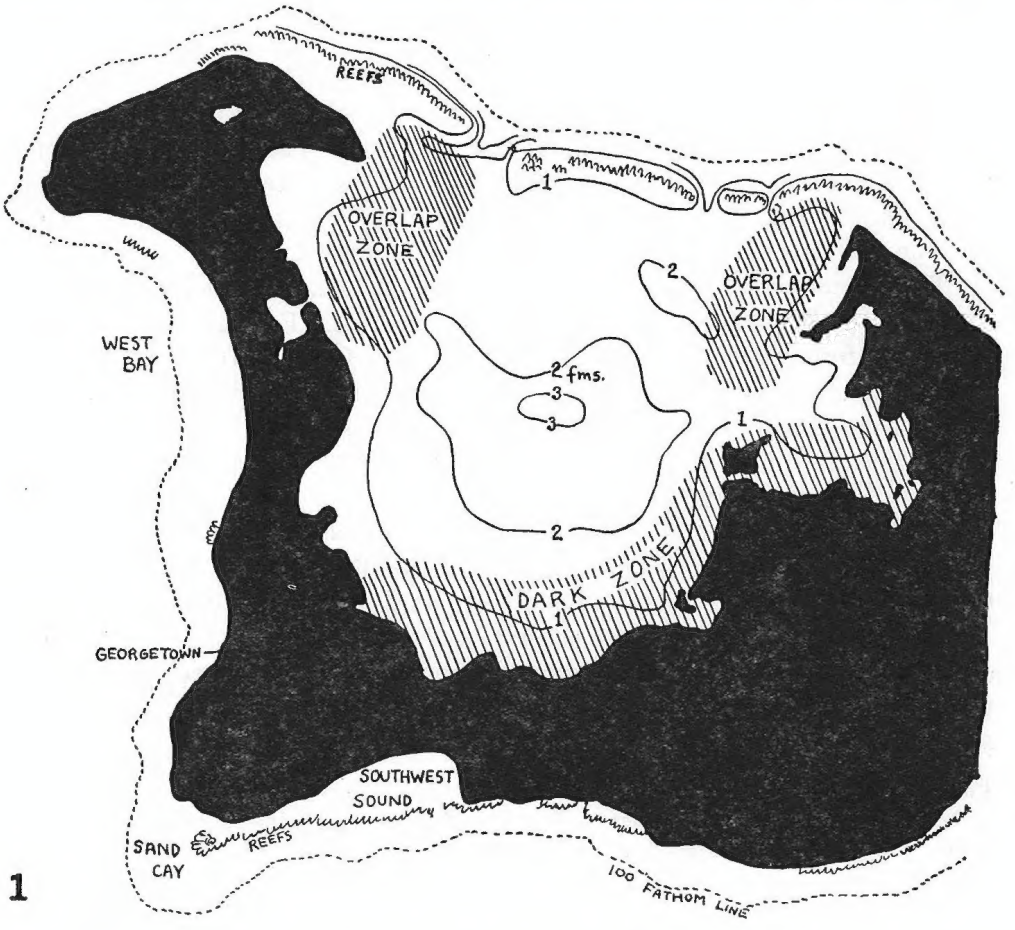
Printed by the George W. Carpenter Fund
for the Encouragement of Original
Scientific Research

PHILADELPHIA
1958

GEOGRAPHY OF GRAND CAYMAN ISLAND

The three small Cayman Islands, which are a dependency of Jamaica, lie a little closer to Cuba than to Jamaica. They are projecting peaks of the Cayman Ridge, a range of submarine mountains continuous with the Sierra Maestra Range of Cuba and running west to the Misteriosa Bank in the direction of British Honduras. A few miles south of this ridge runs the Bartlett Deep which, about 40 miles south of Grand Cayman, is about 3,400 fathoms in depth. The smaller two islands, Cayman Brac and Little Cayman, are about 70 miles northeast of Grand Cayman.

Grand Cayman is a low, flat-topped island capped entirely with limestone rock and sparse, semi-xerophytic vegetation. It is 22 miles long from east to west with a maximum width of about 8 miles. It has an area of about 76 square miles, and the low ridges on its surface vary from 10 to 40



Map. 1. Bathymetric chart of North Sound at the western end of Grand Cayman Island showing the ecological "overlap" and "dark" zones.

feet in elevation. The rainfall varies between 67 and 77 inches per year. The western third of the island is taken up by the large, mangrove-bordered, shallow North Sound, 7.5 by 6 miles in extent, and less than 20 feet in depth (Map 1). The island is cliffed with karstic shoreline except for a three-mile, sandy beach at the west end. It is almost entirely ringed by poorly developed coral reefs which cut across bights, forming sounds or lagoons of sizable dimensions. A detailed and illustrated description of the topography of the island is given by Doran (1954).

The temperature of the ocean waters offshore, from the surface down to 50 meters, is about 26° C (about 78° F) and the salinity 36.00 parts per thousand. The general horizontal circulation of the upper layers of the ocean are from the vicinity of the Isle of Pines, southeasterly across the Cayman Ridge and on to the north coast of Jamaica (Parr, Bull. Bingham Ocean. Coll., vol. 5, art. 5, 1937). We have no inshore temperature records. The spring tide range is 1.1 feet; the mean range 0.9 feet. An informative general account of the island may be found in the biennial Colonial Reports, " Cayman Islands ", sold for two shillings at Her Majesty's Stationery Office, P. O. Box 569, London, S.E.1, England.

COMPOSITION OF THE GRAND CAYMAN FAUNA

A total of 293 species and subspecies of mollusks were obtained from 57 intertidal stations and 103 shallow-water (6 to 60 feet in depth) dredging stations.

Gastropoda	202
Amphineura	11
Scaphopoda	3
Pelecypoda	73
Cephalopoda	4
Total collected	293

RELATIVE ABUNDANCE OF SPECIMENS

No quantitative records were made during the collecting of specimens at Grand Cayman Island, and our remarks concerning the relative abundance of certain species are inferred from the collections as they were received at the Academy. The terms " abundant," " common," and " rare " are not very satisfactory, but we use them nevertheless to give some indication of the relative occurrence of individuals.

In ocean-facing lagoons.—It appears from an examination of the dredging samples from lagoons around the island that the following species are the thirteen which are found in greatest numbers:

Cerithium eburneum
Nassarius albus
Columbella mercatoria
Olivella dealbata
Bulla occidentalis
Rissoina bryerea
Cerithium litteratum
Conus jaspideus
Divaricella quadrisulcata
Tellina similis
Tellina candeana
Tellina listeri
Chione cancellata

In North Sound.—The following are the twelve most abundant species dredged throughout the entire extent of North Sound (depth: 1 to 18 feet):

Bulla occidentalis	*Nassarius albus*	*Lyropecten antillarum*
Astraea phoebia	*Columbella mercatoria*	*Codakia orbiculata*
Cerithium eburneum	*Rissoina bryerea*	*Codakia costata*
Modulus modulus	*Olivella dealbata*	*Pitar fulminata*

On reef flats.—This list of species may not be significant, since no special effort was made to find out which species were most abundant on the reef flats. According to the number of specimens in the collections, and on the basis of the memory of the collectors, the following may be considered to be the most abundant:

Drupa nodulosa	*Conus mus*	*Hipponix antiquatus*
Hemitoma octoradiata	*Astraea caelata*	*Barbatia cancellaria*
Acmaea jamaicensis	*Leucozonia nassa*	*Chlamys ornata*
Diodora listeri	*leucozonalis*	*Barbatia domingensis*

A two gallon dredging sample made in the lagoon at Bluff Bay in 6 feet of water where the bottom consisted of white sand and a small amount of brown algae included 64 species. The 12 species represented by the largest estimated total mass of shells were: *Divaricella quadrisulcata* (450 dead valves), *Tellina radiata* (55 dead valves), *Olivella dealbata* (680 dead), *Tellina similis* (210 dead valves), *Tellina cuneata* (115 dead valves), *Lucina pensylvanica* (13 dead valves), *Hipponix antiquatus* (52 dead), *Strigilla mirabilis* (54 dead valves), *Nassarius albus* (13), *Polinices lacteus* (17), *Bulla occidentalis* (9) and *Tellina listeri* (6 dead valves). The remaining species occurred in considerably less mass and fewer specimens, except for 32 small *Tricolia affinis* and 203 very young *Cerithium.* The others are listed in our census of circum-insular species. This type of assemblage is fairly typical of the narrow lagoons found between the fringing reefs and shoreline of the north coast of Grand Cayman Island. In all likelihood, the above 12 most common species would be represented in a fossil assemblage coming from a similar type of habitat.

Relative abundance in other areas.—There have been no extensive surveys published which would allow a fair comparison of the prevalent Grand Cayman Island species with those from other West Indian areas. Stephenson and Stephenson (1950) in their survey of the Lower Florida Keys observed a great deal of variation from key to key as to which are the commonest snails in the lower tidal zones. Likely, a similar variation occurs around Grand Cayman, for some ecological areas are more suitable than others. It is interesting to note that while some species have large populations at Grand Cayman Island, Florida, Bermuda (Peile, 1926), and Puerto Rico (Dall and Simpson 1901), they may be rare or absent or are replaced by other closely related species in other parts of the West Indies. The greatest similarity in abundance in all these areas is found in the species that live in the middle and lower Ironshore zones (such as *Nerita peloronta,*

Acanthopleura granulata, and *Fissurella barbadensis*). However, the upper Ironshore and reef-flat dominant species are somewhat dissimilar, as for example the absence or rarity in Bermuda and Florida of *Echininus nodulosus, Livona pica* and *Puperita pupa.* Below is a table which shows an example of the varying degree of occurrence of several species as indicated by size of populations.

	Grand Cayman	Bermuda	West Florida	Lower Florida Keys	Bahamas
Murex pomum	very rare	extinct	abundant	uncommon	common
Drupa nodulosa	abundant	rare	absent	abundant	common
Pecten ziczac	absent	common	uncommon	uncommon	rare
Livona pica	abundant	extinct	absent	extinct	abundant
Cancellaris reticulata	absent	extinct	abundant	uncommon	absent
Fasciolaria tulipa	rare	rare	common	common	uncommon (?)
Brachidontes exustus	rare	common	common	abundant	common (?)
Modiolus americanus	rare	abundant	abundant	uncommon	rare (?)

ECOLOGICAL DISTRIBUTION

The significance of the distribution of populations of common species within restricted depth-zones and other ecologic niches has been discussed by Stephenson and Stephenson (Jour. of Ecology, vol. 38, p. 398, 1950) in their study of intertidal Florida species. Knowledge of the influencing factors, usually temperature, substrate, and food, will give great insight into the reasons for these varying sizes of populations in the general tropical Western Atlantic province.

Habitudinal Distribution of Grand Cayman Species

	Chitons	Pelecypods	Gastropods	Scaphopods	Total
Sand Species (177)					
Found everywhere	0	12	15	0	27
Only in North Sound	0	7	6	0	13
North and Frank Sound	0	1	1	0	2
Only circum-insular	1	30	104	3	138
Reef Species (69)	1	13	53	0	69
Mangrove Species (6)	0	0	6	0	6
Ironshore (22)					
Upper	0	0	4	0	4
Middle	3	0	4	0	4
Lower	5	0	8	0	13
Pelagic (5)	0	0	5	0	5
Unspecified					12
				Grand Total	293

Ironshore Fauna (Upper Platform).—Much of the coastline of Grand Cayman Island consists of hard, jagged, dark-gray limestone rock which Doran (1954, p. 369) refers to as " ironshore ". Stephenson and Stephenson (1950) refer to it as the " Upper Platform ". This is a common West Indian type of shore platform which rings many islands, and appears to be the result of wave action upon the underlying marlformation. The Grand Cayman ironshore was searched thoroughly in a few places, but no detailed notes were made concerning the exact numbers and locations of the mollusks. We have attempted to divide the ironshore into three general zones on the basis of the mollusks living there, but these results should be considered incomplete. A detailed field study is much needed. Needlessly to say, there is an overlap in these zones, and some species found in the lower ironshore zone also occur on the dead reef flats where similar conditions exist.

Upper Ironshore.—High tide does not reach this area, but, during rough weather, ocean spray and sea water may wet this zone. In some areas, there exist small puddles of briny water which receive water from rain or splashings from waves. These are termed " splash pools ", and at Grand Cayman they are inhabited by numerous specimens of *Puperita pupa* and *Littorina mespillum.* The only other two snails in the upper ironshore are *Tectarius muricatus* and *Echininus nodulosus,* but neither lives in the splash pools. All species in this zone are common wherever they occur.

Middle Ironshore.—This zone might be considered an upper intertidal area. For a few hours each day at least, waves reach this part of the shore, but the zone is most of the time out of water. However, only during very calm, sunny weather do the rocks become dry, and then only for a relatively short time. All of the species in this zone are common or abundant wherever they occur. Some also occur in the lower ironshore zone. Stephenson and Stephenson (1950, p. 374) refer to this as the lower Yellow Zone.

Nerita peloronta
Nerita versicolor
Littorina ziczac
Nodilittorina tuberculata
Chiton tuberculatus
Chiton squamosus
Acanthopleura granulata

Lower Ironshore.—The substrate in this zone is generally flat or slightly sloping, usually covered with algae, and other marine growths, but in some areas may be worn smooth or cut in to fissures by sand or by waves. The zone is always wet, and is awash or slightly uncovered only at low tide. Conditions here are somewhat similar to those on the higher, offshore reefs, although there are no loose coral boulders for protection. Some of the species listed below are rarely found on the reefs. Most species occuring in this zone are common or abundant wherever they occur, although a few are uncommon or rare.

Fissurella barbadensis (common)
Fissurella angusta (common)
Nerita tessellata (moderately common)
Livona pica (abundant)
Planaxis lineatus (moderately common)
Purpura patula (common)
Thais rustica (moderately common)
Thais deltoidea (moderately common)
Ceratozona rugosa (common)
Acanthochitona spiculosa (rare)
Acanthochitona hemphilli (moderately common)
Callistochiton shuttleworthianus (rare)
Chiton viridis (common)
Octopus vulgaris (common ?)
Octopus hummelincki (common ?)

North Sound Fauna.—North Sound (Map 1, p. 2) is a considerable body of water, some five miles in diameter. Separated from the open sea on the north by reef and shoals, it has a shallow bowl shape with the deepest portion, about 20 feet, just south of the center. In many places the floor is formed by exposed limestone bedrock, while in others it is composed of a thin veneer of marly material or covered by a growth of turtle grass (*Thalassia*) or algae. The shoreline of the sound is determined around most of its periphery by mangroves growing in the shallows. This boundary is transitional because water extends back among the tangle of mangrove roots for considerable distances, as for instance at least three miles east of little Sound (Doran, 1954, p. 367).

The molluscan fauna of North Sound may be divided generally into three types: 1) the mangrove species; 2) exclusively North Sound species; and 3) a few widespread species. Some of these species are rather evenly distributed throughout the sound, while all of the mangroves species and a few others are concentrated around the periphery.

Three special areas should be noted. On map 1 there are two " overlap areas " which denote the regions where living specimens of sound and circum-insular (or coral-water) species are found together. This is evidently made possible by the alternate exchange of sound and ocean water currents during tidal changes. Along the southern and southeastern shores of the sound is a so-called " dark zone " which denotes the region where a number of widespread species exhibit dark pigmentation in their shells. This is undoubtedly correlated with the muddy nature of the bottom in this section of the sound. A third location of interest is Duck Pond, at the southeast corner of the sound. Although its present living fauna is typical of the " dark zone ", there were dredged there a number of dead shells of typical coral-water species. It is possible that these shells were deposited there by some recent hurricane, or that they are semifossils which have been " uprooted " in some manner from a lower level of the floor of the sound.

Exclusively North Sound Species.—The species listed below were found nowhere else, and evidently will not tolerate oceanic or coral-water conditions. These species are more commonly found associated with larger islands. Further ecological remarks are found in the systematic part of this paper.

Anadara notabilis. Rare at 4 stations.
Modiolus americanus. Rare at 2 stations.
Musculus lateralis. Rare at 3 stations.
Lyropecten antillarum. Moderately common at 16 stations.
Aequipecten gibbus nucleus. Rare at 4 stations.
Anodontia alba. Rare at 4 stations.
Pitar fulminata. Abundant at 22 stations.
Tellina guadeloupensis. Uncommon at 9 stations.
Bittium varium. One colony only.
Astraea phoebia. Common at 16 stations.
Prunum apicinum. Uncommon at 4 stations.
Pusia hanleyi. Moderately common at 5 stations.
Crassispira leucocyma. Uncommon at 2 stations.
Haminoea petiti. Abundant at 5 stations.

North Sound and Frank Sound Species.—

Crassinella guadeloupensis. Common at 9 North Sound stations; 5 specimens at one Frank Sound station.
Diodora dysoni. Uncommon at 4 North Sound and 3 Frank Sound stations.

North Sound and Circum-insular Species.—This list includes species which are found throughout many parts of North Sound, the coastal lagoons and off West Beach in depths ranging from 4 to 48 feet. These are essentially coral-water species which have a tolerance for North Sound conditions. They are the so-called " ubiquitous " species.

Glycymeris pectinata. Uncommon at 12 scattered North Sound stations, and only 8 coastal lagoon stations.
Arcopsis adamsi. Uncommon at 5 North Sound stations, but common in coral rubble at 9 coastal lagoon stations.
Pinctada radiata. Uncommon at 5 North Sound and 3 coastal lagoon stations.
Laevicardium laevigatum. Abundant (6 to 30 specimens) at 12 North Sound stations; common (2 to 12 specimens) at 7 stations off West Beach in 12 to 36 feet; and uncommon at 2 Frank Sound stations.
Codakia orbicularis. Common nearly everywhere in sand.
Codakia orbiculata. Common nearly everywhere in sand.
Codakia costata. Common nearly everywhere in sand.
Chione cancellata. Common nearly everywhere in sand.
Gouldia cerina. Uncommon at 3 North Sound and 4 coastal lagoon stations.
Diplodonta semiaspera. Uncommon at 2 North Sound stations, and at one coastal station at Bluff Bay.
Diplodonta punctata. 2 to 10 specimens alive at 4 North Sound stations; uncommon (2 to 3 specimens) at 3 Frank Sound stations; and rare and dead at one South West Sound station.
Cumingia coarctata. 1 to 5 specimens at 5 stations on the west side of North Sound; 1 to 2 specimens at 6 coastal lagoon stations, but not off the west end of the island.
Acmaea pustulata. The turtle grass form was taken in fairly large numbers at 6 North Sound stations and at 13 stations in the coastal sounds wherever turtle grass grows. The rock form was taken on the reefs and dead in sand near the reefs at 19 coastal stations. Both forms in dead condition were dredged at the same stations.
Tegula fasciata. 5 to 20 specimens at each of 16 stations throughout North Sound, and at nearly every station (30) in coastal lagoon areas in sandy areas at depths from 4 to 20 feet.
Tricolia thalassicola. A few specimens were found at 8 North Sound stations, but many were dredged dead and 3 to 15 live specimens at 24 coastal lagoon stations.

Modulus modulus. Very common in North Sound where 4 to 20 specimens were taken at each of 18 widely scattered stations, and moderately common in shallow water at 12 coastal lagoon areas in depths of 4 to 18 feet over sand or sand and turtle grass.

Zebina browniana. Numerous specimens were found at 5 stations in North Sound, and at 10 stations in the coastal lagoons in 5 to 18 feet of water. Its optimum habitat, however, appears to be in the coastal lagoons.

Rissoina bryerea. This is one of the most common of the small gastropods. From 3 to 50 specimens were dredged at 8 stations in North Sound (although not in the center, and 10 to 100 specimens at 18 stations in the coastal lagoons. *Rissoina decussata* was not found in North Sound.

Cerithium eburneum. This is probably the most widely distributed, abundant mollusk at Grand Cayman. It was taken in all sections of North Sound at 12 stations, and at 31 other stations in coastal lagoons and off the west end of the island. It lives in depths from a few inches to 30 feet of water on sand bottom with or without algae.

Cerithium litteratum. This species is as abundant as *C. eburneum,* but was taken at more coastal stations (42) and only in the outer half of North Sound at 7 stations. It was also obtained in sand pockets on reefs and shore benches. It appears to be more tolerant to wave action, but less tolerant to the warm shallow conditions in the inner half of North Sound.

Columella mercatoria. This is one of the very abundant and widely dispersed species at Grand Cayman. It was taken in nearly all sections of North Sound (10 stations), off the west end of the island (7 stations) and in the coastal lagoons (30 stations). Like *C. litteratum,* it may be found in small sand pockets on some reefs and coastal benches.

Anachis hotessieriana. 1 to 5 specimens in each dredging at 4 North Sound stations, those at Duck Pond being dead; and 2 to 8 specimens at 13 coastal sound stations, but not off the west end of the island.

Nassarius albus. Very widely distributed and abundant at Grand Cayman. Numerous at 21 North Sound stations (although not in the center), and numerous at 30 stations in coastal sounds and along the west end.

Olivella dealbata. The distribution of this species is almost identical with that of *Nassarius albus,* and is also absent in the center of North Sound where it was otherwise taken abundantly at 13 stations. Specimens from the inner most edges of the sound are darkly pigmented.

Prunum pruniosum. 3 to 12 specimens at each of 12 North Sound stations, and at 39 coastal and west end stations. It was obtained at one station at the center of North Sound.

Bulla occidentalis. 5 to 25 specimens at each of 10 North Sound stations were very dark in color, while 5 to 25 specimens from the entrance to North Sound, the coastal lagoons and West Bay (34 stations) were medium brown to almost cream in color.

Circum-insular Soft-bottom Fauna.—The following list consists of mollusks found exclusively in the sandy areas of coastal lagoons and small sounds or off the west end or in sandy areas near reefs where there may or may not be turtle grass and other algae. These are the true " coral-water " species. None of these species was found in North Sound proper, but do enter the " overlap " areas near the north entrances to the sound. To this list should be added 26 circum-insular species that are mentioned above as also occurring in North Sound.

Species	No. stations	Depth range (feet)	Specimens per station
Barbatia cancellaria	13	3–12	2–10
Glycymeris decussata	dead beach valves (rare)		1
Pinna carnea	2	4–5	1
Limea bronniana	2	7–?	1
Carditopsis smithi	4	7–12	6–20
Lucina pensylvanica	22	6–40	2–10
Divaricella quadrisulcata	45	5–30	3–25
Trachycardium magnum	dead beach valves (rare)		
Papyridea semisulcata	3	6–48	1
Americardia media	3	8–18	3–5
Americardia guppyi	19	6–48	5–30
Antigona listeri	1	4	1
Chione pygmaea	11	9–45	2–3
Transennella gerrardi	14	8–54	6–30
Tellina radiata	18	6–48	1–50
Tellina laevigata	dead beach valves (rare)		
Tellina listeri	30	6–48	3-20
Tellina similis	34	6–25	5–35
Tellina candeana	26	6–25	5–35
Tellina cuneata	25	6–25	3–10
Tellina sybaritica	4	6–8	2–3
Arcopagia fausta	7	4–6	1–3
Quadrans lintea	1	48	1
Strigilla mirabilis	21	6–48	4–20
Semele bellastriata	6	6–16	2–4
Asaphis deflorata	dead valves (uncommon ?)		
Ervilia concentrica	11	6–30	4–12
Varicorbula operculata	1	48	1
Basterotia quadrata	1	30	1
Basterotia newtoniana	1	6	3
Acmaea pustulata	15	5–15	4–20
Cyclostrema cancellatum	2	6–12	1 (dead)
Turbo castanea	18	5–25	3–20
Smaragdia viridis	26	2–15	10–50
Synaptocochlea picta	18	8–30	2–5
Phenacolepas hamellei	1	5	1 (dead)
Rissoina decussata	4	6–8	1–3
Rissoina cancellata	11	6–25	5–20
Cingulina babylonia	3	6–12	1–2
Alvania auberiana	2	6–8	1–5
Cochliolepis parasitica	3	6–12	3–6 (dead)
Heliacus cylindricus	4	9–30	1–4 (dead)
Alabina adamsi	6	8–25	5–25
Alaba incerta	11	5–16	5–100
Seila adamsi	14	6–25	3–20
Cerithiopsis abrupta	1	12	1
Mathilda barbadensis	1	6	1
Triphora turris-thomae	9	6–30	1–6
Triphora melanura	8	6–12	3–12
Triphora decorata	7	6–18	3–5
Triphora intermedia	2	6	1
Epitonium krebsi	2	6	1
Epitonium echinaticostum	1	8	1 (dead)
Epitonium lamellosum	2	beach, dead	
Epitonium candeanum	1	8	1
Epitonium novangliae	4	6–30	1–3
Opalia crenata	1	3	1 (dead)
Opalia morchiana	3	6–8	1 (dead)
Vanikoro oxychone	1	6	1 (dead)
Tugurium longleyi	1	60	1 (dead)
Strombus gigas	locally very common; 12 to 30 feet.		
Strombus costatus	locally rather common; 20 to 25 feet.		
Strombus raninus	4 dead specimens; rare ? living ?		
Fossarus orbignyi	2	8–12	2–4
Trivia quadripunctata	7	6–18	5–12
Trivia suffusa	2 dead specimens; rare ?		
Trivia pediculus	1	3 dead specimens; rare ?	

Species	No. stations	Depth range (feet)	Specimens per station
Polinices hepaticus	1	beach specimen; rare ?	
Natica canrena	4	beach specimens; uncommon ?	
Natica floridana	3	6–2	1
Natica livida	25	2–50	3–30
Sigatica semisulcata	2	10–60	1
Cassis tuberosa	1	12	2
Cassis flammea	2 dead specimens; rare ?		
Phalium cicatricosum	1	beach specimen; rare ?	
Cymatium femorale	1	beach specimen; rare ?	
Cymatium nicobaricum	7	4–8	1–2
Cymatium muricinum	1	4	1 (reef ?)
Cymatium labiosum	1	4	1 (reef ?)
Charonia variegata	1	8	1
Aspella paupercula	3	6–8	1
Murex pomum	2	2–6	1
Muricopsis oxytatus	1	beach specimen; rare ?	
Anachis catenata	1	5	4
Nitidella nitida	4	5–8	1
Mitrella idalina	1	4	1
Mitrella fenestrata	10	5–16	1–6
Psarostola monilifera	13	8–16	2–12
Bailya parva	4	5–6	1
Fasciolaria tulipa	1	4	4
Latirus trochlearis	2	6	1
Oliva reticularis	(from Grand Cayman ?)		
Olivella nivea	1	6	2
Pusia cubana	5	30–54	2–6
Pusia gemmata	2	5–12	5–6
Voluta musica	1	dredged in 3 feet, fide Salisbury (1953)	
Prunum guttatum	11	3–18	1–2
Hyalina albolineata	5	5–7	1–2
Hyalina avenacea	1	6	1
Hyalina tenuilabra	10	5–20	2–5
Bullata ovuliformis	2	6–8	2–6
Persicula lavalleeana	5	6–8	3–8
Conus jaspideus	47	6–60	3–20
Conus daucus	5	beach specimens	
Terebra hastata	13	5–25	3–15
Crassispira fuscescens	1	10	1
Crassispira nigrescens	4	5–20	1–2
Drillia cydia	2	5–60	1–2
Ithycythara parkeri	1	3	1 (dead)
Pyrgocythara coxi	2	7–8	1
Mangelia bartletti	13	16–40	2–20
Mangelia trilineata	1	6	1
Mangelia biconica	15	8–18	2–5
Mangelia quadrilineata	10	8–18	2–5
Daphnella lymneiformis	1	12	2
Atys riiseana	6	8–20	1–3
Atys caribaea	13	6–18	6–24
Haminoea antillarum	1	dead, beach shell.	
Haminoea elegans	2	6–18	1
Rhizorus acutus	1	dead shell	
Retusa canaliculata	10	8–18	5–25
Pyramidella dolabrata	15	6–24	3–10
Odostomia laevigata	8	6–20	3–12
Triptychus niveus	2	6–8	1
Turbonilla alfredi	2	8–9	1–2
Turbonilla unilirata	1	5	1
Turbonilla pupoides	2	12–16	2–4
Melanella jamaicensis	3	6–25	1–2
Strombiformis auricincta	4	6–8	1–3
Cadulus quadridentatus	4	6–48	2–3
Dentalium antillarum	30	6–48	3–10
Dentalium semistriolatum	8	20–48	1–3
Ischnochiton purpurascens	12	3–18	1–3

Offshore West End Fauna.—Except for the rocky headlands at the extreme north and south, and except for semi-reef conditions in a few inshore localities, the west end of Grand Cayman is a vast, relatively quiet, flat sandy area which slopes gently down to the 100 fathom line to a distance of one to two miles off shore. The sandy ocean bottom is a relatively desolate region, lacking turtle grass, algae or protective rubble and coral blocks, and is doubtlessly subject to at least gentle shifting of fine sand. The mollusks which were sampled here at depths from 16 to 48 feet are quite characteristic: few in species, and nearly all pure white in color. The proportion of bivalves and gastropods is about equal, and all of the latter are light-colored, carnivorous species. This particular type of habitat supports the following species:

PELECYPODS

Laevicardium laevigatum
Americardia guppyi
Divaricella quadrisulcata
Tellina radiata
Tellina listeri
Tellina cuneata
Strigilla mirabilis

SCAPHOPODS

Dentalium antillarum
Dentalium semistriolatum

GASTROPODS

Polinices lacteus
Natica livida
Sigatica semisulcata (rare)
Nassarius albus
Olivella dealbata
Prunum pruniosum
Pusia cubana (uncommon)
Conus jaspideus (smooth form)
Atys riiseana
Atys caribaea

Dredgings on this sandy slope at depths below 60 feet would probably reveal the increasing presence of deep-water species and the absence of typically shallower water forms such as *Laevicardium laevigatum, Tellina radiata,* and *Conus jaspideus.* A fragment of *Tugurium longleyi* was dredged in 60 feet off West Beach, and other normally deep-water species were dredged sparingly in this region(*Drillia cydia, Mangelia bartletti*).

All of the gastropods here are known to be carnivorous. The first four on the list belong to genera that are known to drill holes in bivalves and shells of other and their own species. I am unaware that the others drill through shells and they likely feed on marine worms or are scavengers. I doubt if *Olivella dealbata, Nassarius albus* or *Prunum pruniosum* (which occur also in North Sound) depend specifically upon the above pelecypods or *Dentalium* (which do not occur in North Sound) for food. A number of shells of *Conus jaspideus* had the egg cases of a *Prunum* (presumably *pruniosum*) attached to them, a phenomenon which speaks for the rarity of a hard substratum to which to anchor egg cases.

It is believed that the absence of color and the smoothness in sculpture of *Conus jaspideus,* and the absence of dark pigment in the shells of *Nassarius albus* and *Laevicardium laevigatum* is indicative of the relative sterility (lack of nitrogenous material and algae) and relative quiet waters

of such a habitat. It should be pointed out, however, that smoothness of shell and lack or presence of bright pigments in other species of *Conus* is not necessarily indicative of depths or degree of disturbance of water.

In all likelihood, similar conditions and the same dominant species of mollusks occur in waters around the other parts of Grand Cayman Island a half to one mile off the fringing reefs in depths of 16 to 48 feet. However, future investigation may reveal other predatory or scavenger species which live upon " escapes " from the reefs, which might not be able to survive in the relatively sterile sandy slopes off the west end of the island.

Reef Fauna.—So-called reef-flat conditions grade from zones which are permanently submerged to parts which emerge from the sea at the lowest tides. All sides of Grand Cayman Island, except the west, are flanked by broken stretches of reef-flats or benches which may come close to shore or be separated from land by shallow, sand-bottomed lagoons. The mollusks of the reef flats may be rock-dwellers, either under, on top, or boring within, or they may be sand- and fine rubble-dwellers when such a substrate occurs on the reef flats. No micro-ecological observations were made to determine the exact types of bottom that each species prefers. Many of the reef dwelling species are dislodged from their normal habitat and may be found alive or dead in the proximity of the reef, either to seaward or on the lagoon side. This accounts for some typical reef-dwellers being dredged in several feet of water over sandy bottom.

Species	No. of stations	Relative abundance
Barbatia cancellaria	25	very common (also dredged)
Barbatia candida	4	rare
Barbatia tenera	1	rare
Barbatia domingensis	18	common
Botula fusca	1	rare ?
Lithophaga nigra	1	probably common
Lithophaga bisulcata	1	" "
Chlamys imbricata	2	rare
Chlamys ornata	23	moderately common
Spondylus americanus	3	probably common
Lima lima	17	common
Chama congregata	4	probably common
Chama sarda	1	" "
Lima scabra	3	uncommon
Lima pellucida	2	uncommon
Emarginula ostheimeri	2	rare, dead
Emarginula pumila	4	rare, dead
Hemitoma octoradiata	13	very common
Diodora listeri	20	abundant
Diodora jaumei	2	rare
Diodora minuta	12	uncommon
Lucapina suffusa	14	moderately common
Fissurella nodosa	2	uncommon (?)
Fissurella fascicularis	2	dead, rare ?
Acmaea pustulata	many	" rock form " only
Acmaea jamaicensis	21	common
Acmaea leucopleura	dead shells, probably common	
Tegula lividomaculata	12	common
Arene cruentata	6	uncommon
Turbo filosa	1	dead, rare
Astraea tecta cubana	20	moderately common
Astraea caelata	20	common

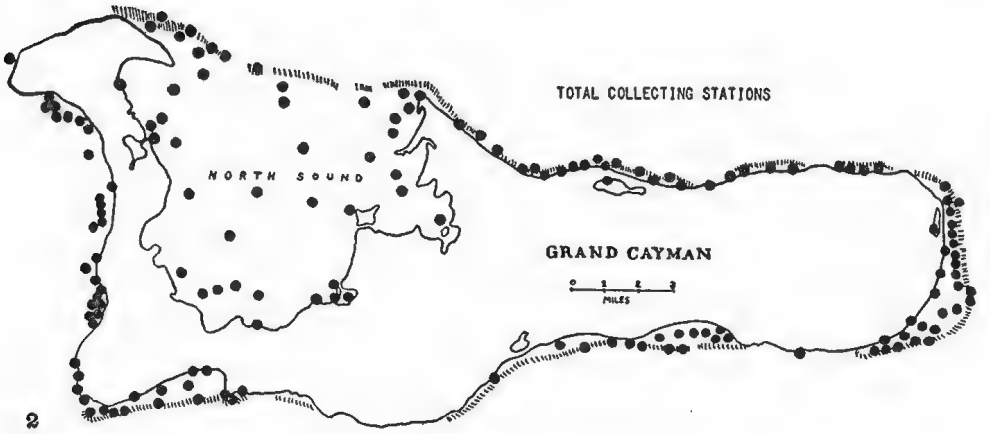
Species	No. of stations	Relative abundance
Vermetus sp.		dead shells, probably uncommon
Cheila equestris	4	uncommon
Hipponix antiquatus	23	common; also dredged dead
Xenophora conchyliophora	2	dead, uncommon
Cyphoma gibbosum	17	moderately common
Cypraea cinerea	17	common
Cypraea spurca	4	uncommon
Cypraecassis testiculus	6	moderately common
Morum oniscus	7	moderately common
Tonna maculosa	6	uncommon
Cymatium martinianum	2	uncommon
Cymatium vespaceum	1	rare
Bursa thomae	1	rare
Bursa cubaniana	12	moderately common
Bursa corrugata	1	rare
Drupa nodulosa	27	abundant
Coralliphila abbreviata	13	common
Coralliphila caribaea	3	uncommon
Coralliophila aberrans	1	rare
Pyrene ovulata	5	uncommon
Engina turbinella	11	moderately common
Colubraria obscura	1	rare
Pisania pusio	13	moderately common
Cantharus auritulus	11	common
Fusilatirus cayohuesonicus	1	rare
Leucozonia leucozonalis	22	abundant
Mitra nodulosa	15	common
Mitra barbadensis	11	moderately common
Pusia puella	1	beach specimen
Prunum guttatum	11	uncommon, in pairs
Hyalina avena	14	uncommon
Conus regius	17	moderately common
Conus mus	21	common
Conus ranunculus	1	rare
Cryptoconchus floridanus	1	rare
Octopus vulgaris (common ?)		
Octopus hummerlincki (common ?)		

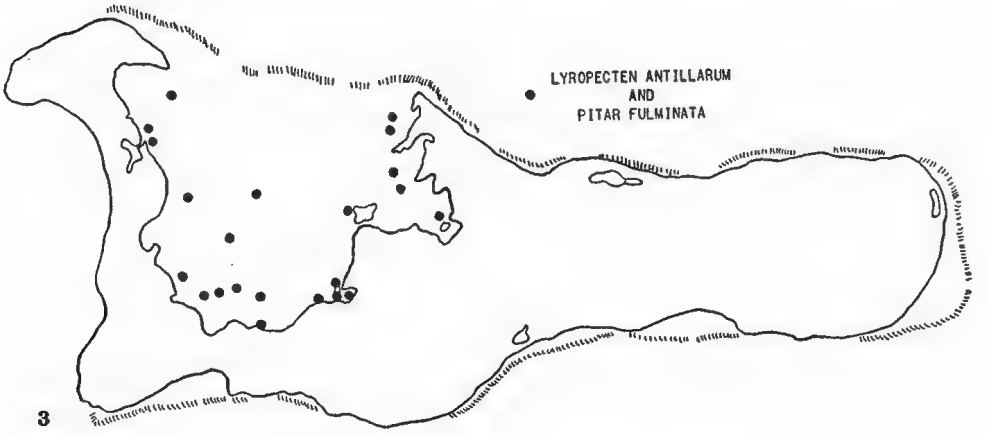
Mangrove Fauna.—No extensive collecting was done in the mangrove areas of Grand Cayman, and our list of 6 species may not be complete. The species below are widely distributed throughout the Caribbean area. It is interesting to note the absence of several common West Indian mangrove species. This leads us to suspect that even the mangrove species may be divided into those that live on small islands and those that are limited to large islands and continental shores.

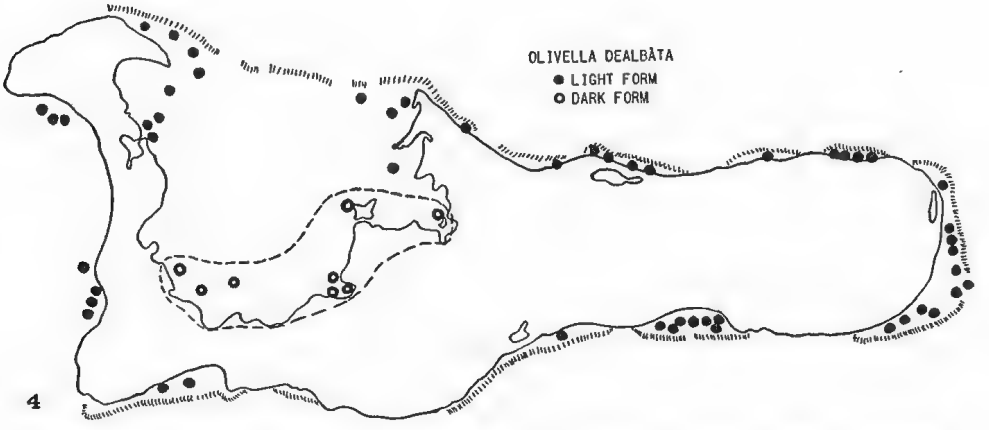
Isognomon alatus
Neritina virginea
Littorina angulifera
Cerithidea costata
Batillaria minima
Cerithium variabile

Pelagic Fauna.—No survey was made of the holopelagic mollusks of Grand Cayman, and those listed below were fortuitously collected in dead condition on the beach or found dead in dredging samples. There are probably about 25 holopelagic species in the area.

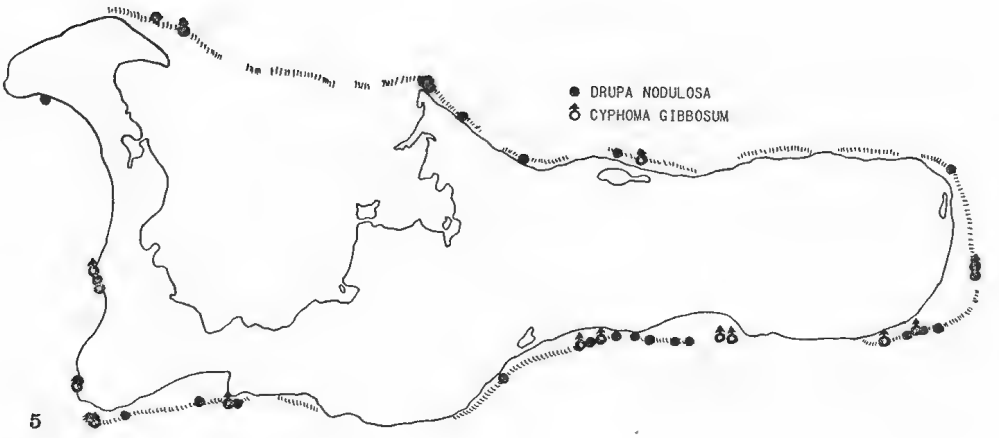
Litiopa melanostoma
Janthina janthina
Janthina exigua
Styliola subulata
Spirula spirula

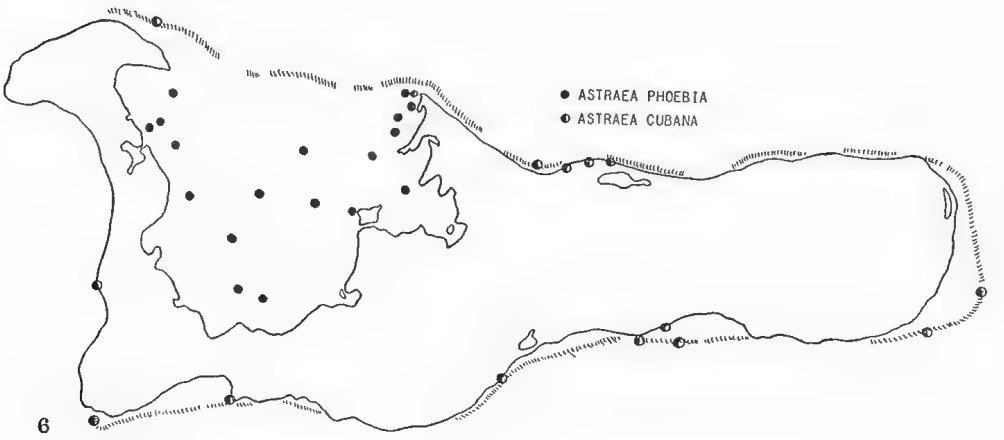


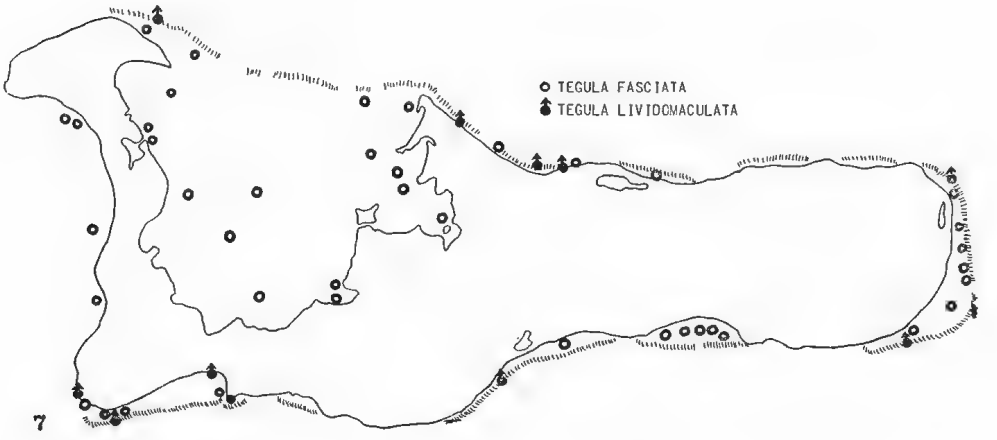




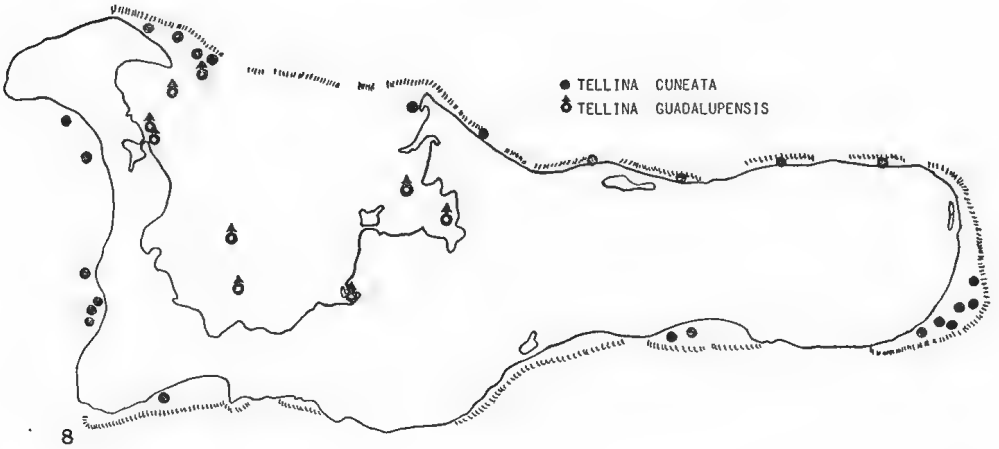
Maps 2-4. Localities sampled for mollusks at Grand Cayman Island. Maps 3 and 4. Locality records for mollusk species.

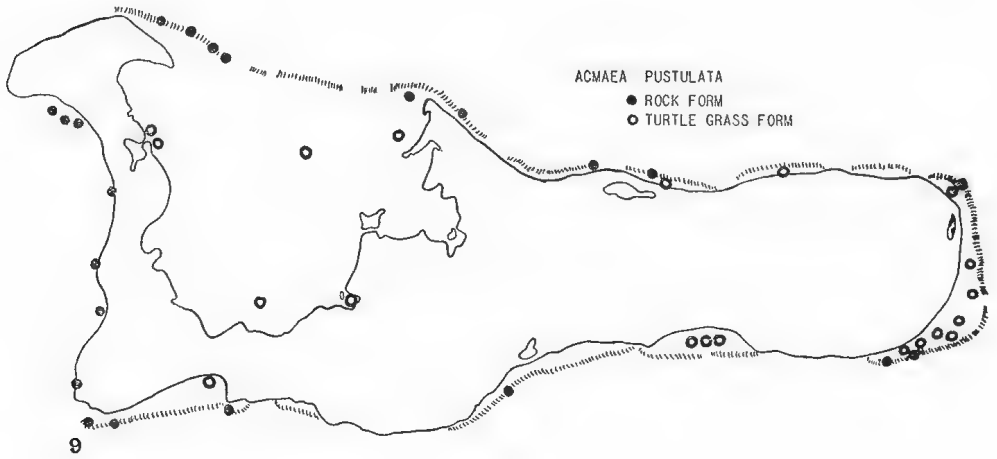


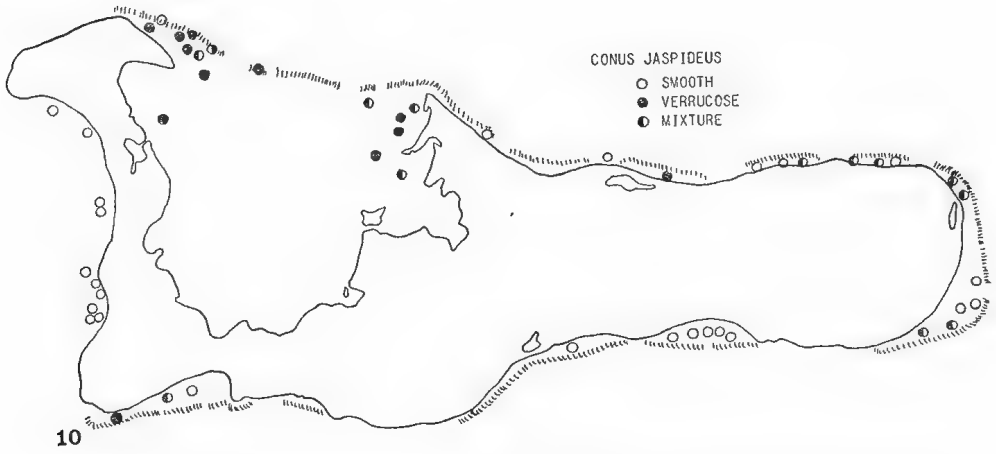




Maps 5–7. Locality records for six gastropod species at Grand Cayman Island.







Maps 8–10. Locality records for four mollusk species at Grand Cayman Island.

SYSTEMATIC TREATMENT

Phylum Mollusca

Class GASTROPODA — Subclass PROSOBRANCHIA

Order ARCHAEOGASTROPODA — Superfamily *PLEUROTOMARIACEA*

Family **FISSURELLIDAE**

Subfamily **EMARGINULINAE**

Genus EMARGINULA Lamarck 1801

Emarginula ostheimerae new species — Plate 1c.

Description.—Shell 10 to 22 mm. in length, solid, rather heavy and coarsely sculptured, quadrate in outline and low. Color opaque ashen-white; interior glossy white. Base oblong, slightly wider behind. Apical whorl one, white, smoothish and very small, and located at about the center of the shell. Sides of shell nearly flat or slightly convex near the margins. Anal fasciole narrow, indistinct, and formed by thicked "inverted-U-shaped", slightly raised lamellae. Fissure very short, about one eighth the length of the anterior slope. Sculpture consists of eight large primary ribs which are made up of 4 to 5 heavily knotted, rounded, distinct radial cords. The bases of these ribs extend well beyond the margin in younger shells. Secondary ribs much smaller, of single cords, and 3 to 5 in number between the primary ribs. Concentric cords stronger than the secondary radial cords, and their intersection forms large rounded nodules. On the interior, the ribs are indicated by weak, broad grooves, but the anal fasciole is not so shown.

Measurements

length	width	height	
22.5 mm.	15.0 mm.	8.0 mm.	Paratype, ANSP no. 195982
13.5	10.0	4.2	Holotype, ANSP no. 195983
9.5	7.0	2.5	Paratype, Ostheimer collection

Types.—Holotype (ANSP no. 195983) and one paratype (Ostheimer collection) were found on the beach west of Old Man Bay, north side of Grand Cayman Island by Mrs. Ruth M. Ostheimer on Nov. 21, 1953. Another large paratype (ANSP no. 195982) was dredged dead in 8 fathoms, ⅓ mile off the Stack, Georgetown Harbour, Grand Cayman, Oct. 28, 1954.

Remarks.—Our three specimens from Grand Cayman are so different from *E. pumila* from Cayman and elsewhere in the West Indies, that we do not hesitate to consider it specifically distinct from the very variable *pumila*. *E. ostheimerae* differs in being much heavier, in having only 8 very large primary ribs which gives the squarish base a stellate appearance. Our specimen of *pumila* from North Sound is equally as depressed as *ostheimerae*, but it is a more delicate shell and with a strongly concave anterior slope.

Emarginula pumila A. Adams 1851 Plate 1d.

Remarks.—This wide-ranging, although not common, species (southeast Florida to Brasil) is characterized by its ovalish outline, 11 to 16 unequal primary ribs, concave anterior slope, and slight groove on the inside of the shell underneath the anal fasciole.

Records.—GRAND CAYMAN: one dead, but fresh specimen was dredged in 10 feet just northwest of Water Point, North Sound; also 9 fathoms, Georgetown Harbour; off Palmetto Point in 5 feet over sand; 6 feet, South West Sound; and intertidal, on rock at Breakers Point.

Genus HEMITOMA Swainson 1840

Subgenus HEMITOMA Swainson 1840

Hemitoma octoradiata Gmelin 1791 Plate 1a and b.

1791 *Patella octoradiata* Gmelin, Systema Nat., 13th ed., p. 3699, no. 36 (insulas Americae mediae; refers to Lister Conch., pl. 532, fig. 11 the type fig. fide A. Adams 1851, p. 90; Martini, Conchyl.—Cab., vol. 1, figs. 82, 83.

1890 *Subemarginula octoradiata* Gmelin, Pilsbry, Manuel of Conchology, vol. 12, p. 273, pl. 29, figs. 17, 18, 37.

1950 *Hemitoma rubida* A. H. Verrill, Nautilus, vol. 63, no. 4, p. 126, pl. 9 (Canefield Point, Dominica).

Description.—15 to 25 mm. in maximum diameter, conic, apex subcentral, inclined backward and to the right; front slope convex, back slope straight. Characterized by 8 strong, radiating ribs between which are one or two secondary, smaller ribs, and by the grayish green or dark slate-gray interior which is whitish at the apex. The anterior, internal groove is narrow and well-marked, but the front margin is not notched.

Remarks.—This common limpet was abundant at 13 stations around Grand Cayman wherever there were exposed and wave-swept rocks. It ranges from southeast Florida through the Caribbean.

Subfamily **DIODORINAE**

Genus DIODORA Gray 1821

Subgenus DIODORA Gray 1821

Diodora listeri Orbigny 1853

Remarks.—A common littoral species at Grand Cayman where it was found on coral rocks on the reefs at low tide. It is considerably more common than *dysoni* Reeve.

Range.—Southeast Florida, Bermuda and the Caribbean.

Records.—GRAND CAYMAN: abundant at 20 littoral stations around the island wherever hard, intertidal substrate is found. Young dead shells were dredged in one fathom at 6 stations a few yards from the reefs.

Diodora dysoni Reeve 1850

Remarks.—This is a moderately common Florida, Bahama and West Indies species. It was taken dead in North Sound in 4 areas and at 3 stations in Frank Sound, Grand Cayman, in 3 to 8 feet of water. It probably lives under rocks on reefs.

Diodora jaumei Aguayo and Rehder 1936

Remarks.—This uncommon, beautiful species ranges from off Lake Worth, Florida, to Trinidad. The Ostheimers obtained only two specimens at Grand Cayman: 9 feet of water off Little Bluff, north shore; 15 feet, coral and sand, West Bay.

Diodora minuta Lamarck 1822

Remarks.—Found common at 12 stations at Grand Cayman in intertidal rocky areas with *D. listeri.*

Range.—Southeast Florida to the Lesser Antilles.

Records.—GRAND CAYMAN: alive, uncommon, on rocks on reef at low tide at Prospect, Breakers Point, Rum Point, and dredged dead 5 to 15 feet on sand in outer part of North Sound and Frank Sound.

Genus LUCAPINA Sowerby 1835

Lucapina suffusa Reeve 1850

Remarks.—This is a fairly common reef species on Grand Cayman found with *Diodora listeri. L. sowerbii* Sowerby was not found at Grand Cayman.

Range.—Southeast Florida and the Caribbean.

Records.—GRAND CAYMAN: all sides of the island where rocky reefs occur. (Prospect; Pease Bay; outer reaches of North Sound; Brinkleys; Colliers Cay).

Subfamily **FISSURELLINAE**

Genus FISSURELLA Bruguière 1789

Subgenus CREMIDES H. and A. Adams 1854

Fissurella nodosa Born 1778

1778 *Patella nodosa* Born, Index Mus. Caes. Vind., p. 448 (Barbados); 1780, Born, Testacea Mus. Caesarei Vind., p. 429 (Barbados; refers to Lister, pl. 528, fig. 6, and others).

1797 *Patella rudis* Röding, Museum Boltenianum, p. 2, no. 13 (refers to Lister, pl. 528, fig. 6).

1943 *Fissurella* (*Cremides*) *nodosa* Born, Farfante, Johnsonia, vol. 1, no. 10, p. 3, pl. 1, figs. 3 and 4; 1954, Abbott, American Seashells, N. Y., p. 100, pl. 17d.

Remarks.—Only one specimen was obtained at Jackson Point, Grand Cayman, on the rocky, wave-dashed shoreline. Salisbury (1953, p. 43) re-

ported six (dead) specimens from off Water Cay. As is the case in Florida and the Bahamas, this species is rare at Grand Cayman, although abundant in Cuba and Navassa Island. It evidently lives further to seaward than *F. barbadensis.*

Fissurella barbadensis Gmelin 1791

Remarks.—This widely dispersed keyhole limpet (southeast Florida, Bermuda and the Caribbean) is abundant along the rocky shores of many West Indian islands, Bermuda and in rock areas of Grand Cayman.

Fissurella angusta Gmelin 1791

Remarks.—Although not as common nor as widely distributed as *barbadensis,* this species was taken at 14 stations and is perhaps more common on Grand Cayman than the former. It was taken alive on rocks with *F. barbadensis.*

Subgenus CLYPIDELLA Swainson 1840

Fissurella fascicularis Lamarck 1822

Remarks.—This is a moderately common species (southeast Florida, Bahamas and south through the Lesser Antilles). Dead specimens were found on the beach at Chisholm House, and Old Man Bay, north shore, Grand Cayman.

Superfamily *PATELLACEA*

Family **ACMAEIDAE**

Genus ACMAEA Eschscholtz 1830

Subgenus COLLISELLA Dall 1871

Acmaea pustulata Helbling 1779 Map 9.

1779 *Patella pustulata* Helbling, Abhandl. Privatgesell. Bohmen . . . , vol. 6, p. 110, pl. 1, fig. 12.

1791 *Patella punctulata* Gmelin, Systema Naturae, 13th ed., p. 3705, no. 68 and p. 3717, no. 132 (refers to Bonanni, pl. 1, fig. 7 and Martini, Conchyl.-Cab., vol. 1, pl. 7, fig. 55).

1819 *Patella puncturata* Lamarck, Anim. sans Vert., vol. 6, p. 333 (Barbados; refers to Lister, pl. 537, fig. 18).

1845 *Patella cubaniana* Orbigny [in Sagra], Historia La Isla de Cuba, vol. 5, p. 272, pl. 25, figs. 4 to 6 (Cuba and Florida).

1891 *Acmaea punctulata* var. *pulcherrima* "Guilding of authors" Pilsbry, Manual of Conchology, vol. 13, p. 38 (Key West type, ANSP 40976). Non *pulcherrima* "Guilding" Petit 1856 = *antillarum* Sowerby.

1927 *Acmaea pulcherrima* "Guilding" Dall, Proc. U. S. Nat. Mus., vol. 70, no. 2668, p. 3 (St. Thomas, West Indies). Non Petit 1856.

Description.—**Rock form** (*pustulata*), 10 to 25 mm. in maximum diameter, wide-oval, moderately to quite solid, usually depressed or rarely coni-

cal, apex acute and nearly central. Surfaces roughly but somewhat weakly sculptured with numerous, low, separate radial riblets of which the third or fourth is usually the larger. Concentric, raised, numerous lamellae much finer than the radial ribs, and sometimes (in unworn specimens) form pustules at their intersection. Color of exterior ashen-white to cream, with or without brown, carmine or reddish specklings or rarely radial bars. Interior usually glossy whitish or yellowish, rarely orange-tinted, and with or without small purplish or brownish flecks or embedded, chalk-white maculations. Margin rarely with about 5 to 10 small light-brown spots.

Turtlegrass form (*pulcherrima* of authors), 10 to 15 mm. in length, moderately to well-depressed, thin and fairly fragile, usually translucent, and oblong in outline. Sculpture weak, but when fully developed consists of fimbriations, concentric lamellae and weak radial, unequal ribs. Color in general pinkish or light yellowish brown, with fine pinkish, brownish and chalk-white maculations or rarely radial bars. Inner margin sometimes pinkish or purplish. The side edges of larger specimens usually show a pinching in or constriction probably due to the limiting width of the leaves of the *Thalassia* turtlegrass. Intergrades in sculpturing and similarity in color patterns exist between the rock and turtlegrass form.

Remarks.—This widely dispersed and variable West Indian species exhibits morphological variations in the shell which appear to be correlated with the substrate and other ecological conditions. The thin, oblong, tan to pinkish form which we term the "turtlegrass form" was dredged in the quiet waters of North Sound, (5 stations, 5 to 12 feet, grass and muddy sand), South West Sound (one station inshore), Frank Sound (3 stations, 5 to 8 feet, on grass, sand bottom) and East Sound (6 stations, 5 to 15 feet, feet, grass beds and sand). Most of these stations were not very far from mangroves. The rock form was collected in clear, more exposed, coral bottom areas from 5 to 18 feet off North Sound, and the fringing reefs off the west end, Frank Sound and South West Point.

The name *pulcherrima* Guilding was first validated by Petit (1856, Jour. de Conchyl., vol. 5, p. 155) when it was put into the synonymy of "*Patella candeana* Orbigny". The latter is a synonym of *antillarum* Sowerby 1831, a common West Indian species which, oddly enough, is absent or extremely rare on Grand Cayman Island.

Range.—Lower Florida Keys, Bermuda and the West Indies to the Lesser Antilles.

Records.—Grand Cayman; around most of the island at 26 stations, including the rock and turtlegrass forms (see under remarks).

Acmaea jamaicensis Gmelin 1791

1791 *Patella jamaicensis* Gmelin, Systema Naturae, 13th ed., p. 3715, no. 124 (Jamaica; refers to Martini, Conchyl.-Cab., vol. 1, fig. 37). Not Gmelin, ibid., p. 3730, no. 200.

1798 *Patella fungoides* Röding, Museum Boltenianum, p. 8, no. 78, (refers to Lister, fig. 539, fig. 23; no locality).

1845 *Patella albicosta* C. B. Adams, Proc. Boston Soc. Nat. Hist., vol. 2, p. 8 (Jamaica); fig. of holotype in Clench and Turner, 1950, Occ. Papers Mollusks, vol. 1, no. 15, pl. 36, figs. 1 and 2.

1954 *Acmaea jamaicensis* Gmelin, Abbott, American Seashells, N. Y., p. 106, pl. 17c.

Description.—10 to 25 mm. in maximum diameter, moderately high, ovalish in outline, usually with rounded sides, thick, with about 15 to 20 rather large, rounded, white radial ribs on a black-brown background, rarely all white. Interior white, rarely with a black-spotted margin and with a thickened, light-brown to black callus.

Remarks.—Martini's figure is not particularly good, but seems to fit the only large, ribbed Acmaea from Jamaica. If Gmelin's name is abandoned, Röding's *fungoides* would apply, since it is based upon a diagnostic figure in Lister based upon a Barbados specimen.

The shells at Grand Cayman and elsewhere in the West Indies are quite variable, especially in height and in the strength of the radial ribs. The margin of the shell may be grossly crenulate due to the strong ribbing or may be finely crenulate or even worn smooth.

Range.—Southeast Florida and the West Indies.

Records.—GRAND CAYMAN; on rocks at low tide on reefs at 21 stations. It is moderately common where found, and associated with the rock form of *A. pustulata.*

Acmaea leucopleura Gmelin 1791

1791 *Patella leucopleura* Gmelin, Systema Naturae, 13th ed., p. 3699, no. 34 (refers to Lister, pl. 539, fig. 22; Martini Conchyl.-Cab., vol. 1, figs. 56, 57).

1798 *Patella digitale* Röding, Museum Boltenianum, p. 7 (refers to Martini, vol. 1, fig. 57).

1798 *Patella papillaris* Röding, loc. cit., p. 7 (refers to Lister, pl. 539, fig. 22).

1954 *Acmaea leucopleura* Gmelin, Abbott, American Seashells, N. Y., p. 106, pl. 17, fig. 17b.

Remarks.—This high-conic, smoothish, 1/3 inch-long *Acmaea* is common from Florida to the Lesser Antilles. It has numerous alternating black and white radial lines. One dead specimen was collected on the beach near Little Bluff on the north shore of Grand Cayman, but it is probably not uncommon. It has been found in Cuba clinging to the underside of *Livona pica* Linné. *A. cubensis* Reeve 1855 and *cubensis simplex* Pilsbry 1891 are synonyms.

Superfamily *TROCHACEA*

Family **TROCHIDAE**

Subfamily **GIBBULINAE**

Genus SYNAPTOCOCHLEA Pilsbry 1890

Synaptocochlea picta picta Orbigny 1842

1842 *Stomatia picta* Orbigny [in Sagra], L'Isle Cuba, Mollusques, pl. 24, figs. 19-20; 1853, vol. 2, p. 184 (Cuba).

1890 *Synaptocochlea picta* Orbigny, Pilsbry, Manual of Conchology, series 1, vol. 12, p. 29, pl. 54, figs. 19, 20; pl. 21, figs. 22-25; 1900, Verrill and Bush, Trans. Conn. Acad. Arts and Sciences, vol. 10, p. 525, fig. 1 (radula).

Description: Shell minute, 2 to 4 mm. in length, auriculiform, last whorl proportionately very large, white with mauve maculations which grade to deep reddish purple sometimes black; darker colors run along the raised cords. Live shells oily glistening in appearance and semi-translucent in structure. Whorls three; nucleus translucent-white, flattened. Second whorl usually white and with red flammules. Spire short, obtuse. Body whorl ovate. Post-nuclear whorls with 15 to 18 unequal spiral cords which are crossed by numerous, weakly-incised, axial striae, giving a slightly beaded appearance to the shell. White areas may obscure the presence of the cords. Suture smooth, slightly indented; columella white; umbilicus shallow but broad; aperture obliquely ovate, elongate, interior shining and semi-translucent with the outer coloration showing through but not nacreous.

Remarks.—This species is moderately common at Grand Cayman. Dead shells were dredged in sand in water 6 to 14 feet in depth in the vicinity of reefs at 10 stations. Mr. Parker believes that it lives among coral and coralline algae on the reefs. The Cayman Island specimens are characterized by having rather strongly developed spiral ribs. In other parts of the West Indian region, specimens may have finer and more numerous ribs. This form has been found in the Lower Florida Keys, is dominant in Bermuda and rare in the Virgin Islands. This is the form or subspecies *nigrita* Rehder 1939 (Nautilus, vol. 53, p. 20, pl. 6, fig. 1 from Dry Tortugas, Florida). It has as wide a color range as *picta,* although pure white or black specimens appear to be more common.

I can see little difference between the Atlantic *picta,* especially the form or subspecies *nigrita* Rehder, and the Indo-Pacific *concinna* Gould 1845, except perhaps that the latter usually has weaker spiral ribs in most specimens. At best, it should be considered a subspecies of *picta. Stomatella concinna inconcinna* Pilsbry 1921 (Proc. A.N.S.P., vol. 72, p. 380 from Honolulu, Hawaii) is probably only an albino form. A cotype of *Stomatella caliginosa* H. and A. Adams 1863 (Proc. Zool. Soc. London for 1863, p. 434, no locality) in ANSP no. 40739 strongly suggests that this species is a synonym of *picta concinna* Gould. *S. asperulata* A. Adams 1850 from St. Helena Island appears to be a good subspecies of *picta* which has a finely beaded surface.

Genus LIVONA Gray 1842

Livona pica Linné 1758

Remarks.—The large, common West Indian Top-Shell is common along the rocky intertidal and sublittoral areas on Grand Cayman. The natives eat the flesh in the form of a chowder.

Range.—Bahamas, and the Caribbean as far south as Trinidad.

Subfamily **MONODONTINAE**

Genus TEGULA Lesson 1832

Subgenus AGATHISTOMA Olsson and Harbison 1953

Tegula fasciata Born 1778 Map 7.

1778 *Trochus fasciatus* Born, Index Rerum Natur. Mus. Caesarei Vind., p. 336 (no locality); 1780, Testacea Mus. Caesarei Vind., p. 331, pl. 2, figs. 3 and 4 (no locality).

1791 *Turbo dentatus* Gmelin, Systema Naturae, 13th ed., p. 3601 (no locality; refers to Chemn. Conchyl.-Cab., vol. 5, figs. 1767, 1768).

1822 *Trochus carneolus* Lamarck, Anim. san Vert., vol. 7, p. 29 (no locality).

1842 *Trochus hotessierianus* Orbigny, [in sagra] Hist. L'Ile de Cuba, Mollusques, vol. 2, p. 59, pl. 18, figs. 15-17 (Cuba, Antilles, Florides, Sainte-Lucie, etc.).

1845 *Trochus occultus* Philippi, Abbild. und Beschr. Conchyl., vol. 2, p. 29, pl. 5, fig. 8 (no locality).

1845 (Jan.) *Monodonta maculo-striata* C. B. Adams, Proc. Boston Soc. Nat. Hist., vol. 2, p. 6 (Jamaica); lectotype on pl. 39, fig. 13 in Clench and Turner, 1950, Occ. Papers Moll., Cambridge, Mass., vol. 1, no. 15.

1877 *Adeorbis picta* Tenison-Woods, Proc. Roy. Soc. Tasmania for 1876, p. 146 (see Hedley 1902, Nautilus, vol. p. 49).

1889 *Chlorostoma substriatum* Pilsbry, Manual of Conch., vol. 11, p. 187, pl. 29, fig. 78 (type locality here designated: Bahamas). Holotype ANSP no. 40831.

1954 *Tegula fasciata* Born, Abbott, American Seashells, N. Y., p. 118, pl. 17p.

Description.—Adult 10 to 18 mm. in length, turbinate, depressed, thick and solid, umbilicate, and smooth to weakly lirate or with a microscopic, spiral " silky " texture. Color very variable, usually with a whitish or buff ground color which is heavily overlaid with maculations of either brown, reddish, orange, purple or blackish, and usually bearing over this numerous fine spiral rows of white and brown or reddish dots. Obliquely slanting axial flames sometimes present. Umbilicus colored or whitish, rarely all black. Whorls 6 to 8, the apex obtuse, upper whorls slightly rounded and bearing fine spiral threads which may or may not persist in the later whorls. Last whorl well-rounded, but flattened beneath the suture, and sometimes descending. Umbilicus round, narrow, deep, either smooth or (especially in young) bordered by 1 to 3 spiral cords. Base usually smooth. Outer lip usually thickened within by an axial shelf and with a dozen or so fine spiral teeth. Interior of aperture whitish pearl. Parietal callus white, shelf-like; columella short, sharp, and strongly curved, and with one large and one or two small tubercles at the base. Operculum horny, thin, round, multispiral with about a dozen visible whorls, light tan in color.

Remarks.—After examining a large series of lots from many parts of the West Indies, we have concluded that *hotessieriana* and *maculostriata* are merely threaded forms. All specimens of *fasciata* are spirally threaded in the early whorls, but, as growth continues, these threads are usually lost. The spiral cords in the umbilicus are also variable in strength, and more evident in smaller, more strongly threaded forms. The latter form occurs in all colors, but the bright rose shells were named *substriata* Pilsbry 1889. This species is replaced from Panama to Trinidad and south to Brasil by a

closely-related rugose, beaded species, *Tegula viridula* Gmelin 1791. The genus name, *Tegula,* is feminine, and not neuter as some authors indicate.

This species (with its several color and sculptural forms) is very common on Grand Cayman Island where it was obtained at 56 stations. It is one of the most widespread shallow water species on the island, being found in 5 to 15 feet of water in clear white sand, sandy mud or mangrove mud not only around most of the open coast but also in nearly every place within the quiet, warm North Sound. We could not note any correlation between shape, color and sculpturing and its wide choice of environments.

Range.—Southeast Florida, Yucatan and Bahamas to the Lesser Antilles.

Records.—GRAND CAYMAN: common at 58 stations along the entire coast and within North Sound.

Tegula lividomaculata C. B. Adams 1845 Map 7; Plate 2s and t.

1842 *Trochus canaliculatus* Orbigny, [in Sagra] Hist. L'Ile de Cuba, Mollusques, vol. 2, p. 60, pl. 18, figs. 18, 19 (Cuba). Non Brocchi 1814, Borson 1825, Cristofori and Jan 1832, Quoy and Gaimard 1834, Philippi 1836.

1844 *Trochus scalaris* "Anton" Philippi, Abbild. und Beschr. Conchyl., vol. 1, p. 140, pl. 4, fig. 11 (Laguayra). Non Roemer 1836.

1845 *Monodonta livido-maculata* C. B. Adams, Proc. Boston Soc. Nat. Hist., vol. 2, p. 7 (Jamaica); lectotype on pl. 39, fig. 11 in Clench and Turner 1950, Occ. Papers Moll., Cambridge, Mass., vol. 1, no. 15.

1848 *Trochus gundlachi* Philippi, Zeitschr. für Malak., 1848, p. 108 (Cuba); Conchyl-Cab., p. 226, pl. 34, fig. 13.

1877 *Astele turbinata* Tenison-Woods, Proc. Roy. Soc. Tasmania for 1876, p. 145 (see Hedley 1902, Nautilus, vol. 16, p. 49).

1889 *Chlorostoma scalare* Anton, Pilsbry, Manual of Conchology, vol. 11, p. 185, pl. 29, figs. 70-73.

Description.—Adult shell 11 to 14 mm. in length, slightly broader, turbinate, depressed, broadly and deeply umbilicate; with about a dozen, fine, beaded, spiral threads on the whorls. Color cream with large maculations and axial flames of purplish to reddish brown, sometimes with spiral rows of tiny white dots. Between the spiral threads are numerous, crowded, microscopic, axial fimbriations. Umbilicus deep, cream, with two spiral ribs within, one terminating in the broad callus of the columella at its junction with the body whorl, the other ending in the largest of the two basal teeth on the nacreous columella. Interior of aperture whitish and nacreous. Operculum horny, round, multispiral and light-brown.

Remarks.—We agree with Pilsbry (1889, p. 186) that the "*Globulus indusii* Chemnitz" is based upon too poor an illustration for satisfactory determination (Conchyl.-Cab., vol. 5, fig. 1682). Therefore, we consider the following names as dubious: *Omphalius indusii* "Chemitz" Mörch 1852, *Trochus carneus* Gmelin 1791, p. 3574, and *Turbo crenulatus* Röding 1798, p. 89.

This species is moderately common and was found at 12 stations in shallow, intertidal waters on rocky, fringing reefs facing the open ocean. It was usually found in company with *Tegula fasciata,* except in the quieter, warmer waters of North Sound.

Range.—Lower Florida Keys, Bahamas, and the Greater and Lesser Antilles.

Records.—GRAND CAYMAN: moderately common at 12 stations on intertidal, rocky fringe reefs on all sides of the island, except the central west end.

Family **TURBINIDAE**

Subfamily **LIOTIINAE**

Genus ARENE H. and A. Adams 1854

Arene cruentata Mühlfeld 1829

1829 *Turbo cruentatus* Megerle von Mühlfeld, Ges. Nat. Fr. Berlin Verh., vol. 1, pt. 4, p. 211, pl. 7, figs. 8a, b. (English Islands of the West Indies).

1839 *Delphinula radiata* Kiener, Coquilles Vivantes, vol. 10, *Delphinula*, p. 7, no. 4, pl. 4, fig. 9 (les mers de L'Inde).

1939 *Arene vanhyningi* Rehder, Proc. U. S. Nat. Mus., vol. 93, p. 192, pl. 19, figs. 15, 16 (Sand Key, 8 mi. south of Key West, Florida).

Description.—Shell 7 to 9 mm. in length and 9 to 12 mm. in diameter, turbinate, deeply umbilicate, whitish with 7 to 12 large, squarish to oblong bright rose splotches on the upper part of the whorl. 4 to 6 whorls angular with the periphery bearing a series of about a dozen, strong, triangular spines which are hollow on their anterior edges; below is a smaller spiral row of minor spines. Suture channeled. Axial sculpture of microscopic, crowded, sharp threads, although sometimes weak or absent (form *vanhyningi*). Aperture circular, pearly within. Umbilicus round, very deep, and bordered by 3 spiral, beaded cords. Operculum circular, multispiral, with rows of tiny calcareous, rounded beads on top of the horny base.

Range.—Lower Florida Keys and the West Indies.

Records.—GRAND CAYMAN: Uncommon on reefs at night at low tide at Brinkleys and 1 mile east of Brinkleys, north shore; Boat channel, off Palmetto Point; south side of East Channel, Gun Bay; and the reef off Collier's Point at the east end of the island.

Genus CYCLOSTREMA Marrayat 1818

Cyclostrema cancellatum Marryat 1818

Remarks.—A dead but fine specimen was dredged in 6 feet of water in the channel leading into Bluff Bay, Grand Cayman. It is a widespread West Indian species.

Subfamily **TURBININAE**

Genus TURBO Linné 1758

Subgenus MARMOROSTOMA Swainson 1829

Turbo castanea Gmelin 1791

1791 *Turbo castanea* Gmelin, Systema Naturae, 13th ed., p. 3595, no. 28 (in Mari Americam australem; refers to Chemn. Conchyl.-Cab., vol. 5, figs. 1807, 1808, and others).

1954 *Turbo castaneus* Gmelin, Abbott, American Seashells, p. 123, pl. 3g (in color).

Remarks.—This well-known and common West Indian species (North Carolina to Florida, Texas, and the West Indies) is moderately common at Grand Cayman. It lives in moderately deep water from 5 to 25 feet where the bottom is clear sand and grassy. It occurs with *Strombus gigas* and apparently requires cool, pure, ocean water, although colonies of *castanea* have invaded the northeast corner of North Sound where, however, there is little influence from the brackish warm waters. The Cayman specimens are usually 20 mm., rarely 25 mm., in length, usually beaded, rarely fimbriated, and colored a dark greenish purple or dark olivaceous with white specklings. The operculum is round, swollen, calcareous, glossy, and white with a purplish rose flush. *T. crenulatus* Gmelin 1791 is a synonym. Gmelin originally used the trivial name *castanea* as a substantive noun, and not as an adjective.

Turbo filosus Wood 1828 Plate 2o.

1828 *Trochus filosus* Wood, Suppl. Index Testac., p. 17, pl. 5, Trochus, fig. 23 (no locality).

1873 *Turbo filosus* Kiener, Fischer, Icon. Coquilles Vivantes, vol. 10, Turbo, p. 40, pl. 13, fig. 2.

1856 *Turbo cailletii* Fischer and Bernardi, Jour. de Conchyl., vol. 5, p. 294, pl. 10, figs. 10, 11 (Guadeloupe).

Remarks.—This rare species which resembles *castanea* is characterized by about a dozen smooth spiral cords on the body whorl, broadness of the lower half of the columella, slight umbilication, and absence of beads. One dead specimen, 28 mm. in length, was found on Grand Cayman. It has also been found at Dry Tortugas and Guadeloupe.

Genus ASTRAEA Röding 1798

Subgenus CALCAR Montfort 1810

Astraea tecta americana Gmelin 1791

1791 *Trochus americanus* Gmelin, Systema Naturae, 13th ed., p. 3581, no. 94 (Americam australem; refers to Chemn. Conchyl.-Cab., vol. 5, figs. 1534, 1535).

1798 *Trochus anilis* Röding, Museum Boltenianum, p. 82, no. 1068 (refers to Chemn. Conchyl.-Cab., vol. 5, figs. 1534, 1535).

1954 *Astraea americana* Gmelin, Abbott, American Seashells, p. 124, pl. 3i (in color).

Description.—Shell 20 to 40 mm. in length, trochiform, elevated, imperforate, solid, whitish to yellowish brown in color; whorls 7, flattened or slightly concave on their upper surfaces, axially obliquely plicate, the folds numbering from 21 to 38 (usually 27 to 32) on the last whorl, terminating on the periphery in rounded nodules (or spines in very young); periphery angled, usually somewhat swollen; base nearly flat, more or less sharply radiately striate, and with 5 to 6 spiral lirae; columella short, heavy, with two small tubercles at the base, and bounded by a radially plicate cord.

Range.—Limited to the Lower Florida Keys.